



K22U 1295

Reg. No. :

Name :

II Semester B.Sc. Degree (C.B.C.S.S. – O.B.E. – Regular/
Supplementary/Improvement) Examination, April 2022
(2019 Admission Onwards)
COMPLEMENTARY ELECTIVE COURSE IN MATHEMATICS
2C02 MAT – CH : Mathematics for Chemistry – II

Time : 3 Hours

Max. Marks : 40

PART – A

Answer **any 4** questions.

(1×4=4)

1. Let $u(x, y) = \frac{1}{x^2 + xy + y^2}$. Write the value of $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$.

2. Evaluate $\int_0^{\frac{\pi}{2}} \sin^3 x \, dx$.

3. Graph the set of points whose polar co-ordinates satisfy $-3 \leq r \leq 2$ and $\theta = \frac{\pi}{4}$.

4. Find the value of the integral $\int_0^1 \int_1^2 \int_0^3 4 \, dx dy dz$.

5. If λ is an eigenvalue of the matrix A, prove that λ^2 is an eigenvalue of A^2 .

PART – B

Answer **any 7** questions.

(2×7=14)

6. Find the limit of $\frac{x(y-1)}{y(x-1)}$ when x and y tends to 1, if it exists.

7. If $u = x^2 + y^2 + z^2$, $x = e^t$, $y = e^t \sin t$ and $z = e^t \cos t$, prove that $\frac{du}{dt} = 4e^{2t}$.

P.T.O.



K22U 1295

-2-

8. Show that $\int_0^{\pi} \sin^7(x/2) dx = \frac{32}{35}$.
9. Evaluate $\int_0^{\pi} \sin^6 \theta \cdot \cos^4 \theta d\theta$.
10. Find the area of the region bounded by the parabola $y = 2 - x^2$ and the line $y = -x$.
11. Find all polar co-ordinates of the point $P(3, \pi/6)$.
12. Find the perimeter of the circle $x^2 + y^2 = a^2$ using polar co-ordinates.
13. Find the volume of the region bounded by the elliptical paraboloid $z = 10 + x^2 + 3y^2$ and below the rectangle $R : 0 \leq x \leq 1, 0 \leq y \leq 2$.
14. Find the average value of $f(x, y) = x \cos(xy)$ over the rectangle $R : 0 \leq x \leq \pi, 0 \leq y \leq 1$.
15. Find all characteristic values of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$. Hence find the characteristic vector associated with any one characteristic value.

PART - C

Answer **any 4** questions.

(3×4=12)

16. If $u = \sin^{-1}\left(\frac{\sqrt{x} - \sqrt{y}}{\sqrt{x} + \sqrt{y}}\right)$, show that $\frac{\partial u}{\partial x} = -\frac{y}{x} \frac{\partial u}{\partial y}$.
17. If $u = e^{x^2+y^2}$, show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 2u \log u$.
18. Using reduction formula, evaluate $\int \tan^4 x dx$.
19. Evaluate $\int_0^a \frac{x^7}{\sqrt{a^2 - x^2}} dx$.
20. Evaluate $\iint xy dx dy$ over the positive quadrant of the circle $x^2 + y^2 = a^2$.



21. Verify Cayley-Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ and hence find its inverse.
22. Find the nature of the quadratic form $3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$.

PART – D

Answer **any 2** questions.

(5×2=10)

23. If $u = x \log(xy)$, where $x^3 + y^3 + 3xy = 1$, find $\frac{dy}{dx}$ and hence find $\frac{du}{dx}$.
24. Evaluate $\int_0^1 x^{3/2} (1-x)^{3/2} dx$.
25. Find the area of the region R enclosed by the parabola $y = x^2$ and the line $y = x + 2$ using double integrals. Graph the required area.
26. Find the characteristic values and characteristic vectors of the matrix

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}.$$
